REMARKS

Claims 1-24 are pending. Claim 1 has been amended.

Claims 1, 4-7, and 12-15 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Pat. No. 6,137,100 to Fossum et al. Applicant respectfully requests reconsideration of this rejection.

Claim 1 recites a macro-pixel that includes, *inter alia*, "at least two color pixel elements of substantially equal pixel area." Each color pixel element includes "a photoreceptor having a device geometry, responsive to receiving light, to generate an output signal indicative of an amount of light photons received." The photoreceptor of the "first of the color pixel elements" receives "a first color of light" and has "a first geometry and a responsivity to said first color of light that is a function of the first geometry." The photoreceptor of the "second of the color pixel elements" receives "a second color of light different from the first color of light" and has "a second geometry different from the first geometry and a responsivity to said second color of light that is a function of the second geometry."

Fossum et al. '100 discloses a macro-pixel that features different pixel sizes for different colors. Fossum et al. '100 varies the pixel area or "collection area" to adjust conversion gain G_n for the different color bands. The pixel "collection area" being adjusted according to Fossum et al. '100 is not the "photoreceptor...device geometry" recited in claim 1.

More specifically, Fossum et al. '100 teaches that the pixel "collection area" is, in effect, the area of the *pixel* covered by a filter of a particular color. It is the area of the pixel with which Fossum et al. '100 is primarily concerned. The pixel collection area is defined in Fossum et al. '100 and applicant's specification as the variable A_n, which is a factor in the equation for output voltage V_n. See col. 2, line 25 of Fossum et al. and paragraph 15, line 3 of applicant's specification.

As defined in applicant's specification and recited in claim 1, however, the "photoreceptor device geometry" refers to the size, shape, depth, etc. of the depletion area of the *photodiode* (the "photodiode area" or the "photodiode size"). Thus, photodiode device geometry applies to an area that lies within the pixel collection area, and not the pixel collection area A_n. By default, the photodiode size will be less than the pixel collection area. This distinction between pixel area and photodiode size is critical to understanding of the application and the references.

Fossum et al. '100 teaches that pixel conversion gain G_n can be increased by increasing the *pixel* collection area. Increasing the area of the *photodiode*, however, may bring about a concomitant *decrease* in conversion gain G_n. Thus, Fossum et al. '100 teaches at col. 3, lines 22-37, that the area of the photodiode (photodiode size) should *not* change when the pixel area is increased. Specifically, Fossum et al. '100 teaches one "to increase the photosensitive area of the pixel *without* corresponding increase in the size of the doped photodiode region." Fossum et al. '100 does not teach or suggest a macro-pixel with "each color pixel element including a photoreceptor having a device geometry" and "the photoreceptor of a first of the color pixel elements receiving a first color of light and having a first geometry and a responsivity to said first color of light that is a function of the first geometry," and "the photoreceptor of a second of the color pixel elements receiving a second color of light different from the first color of light and having a second geometry different from the first geometry and a responsivity to said second color of light that is a function of the second geometry."

Claim 1 is patentable over Fossum et al. '100. Claims 4-7 and 12 depend directly or indirectly from claim 1 and are patentable over Fossum et al. '100 for at least the same reasons.

Claim 13 recites a CMOS color pixel assembly that includes "a plurality of macro pixels, each macro pixel of the plurality of macro pixels." Each micro pixel includes "at least three color pixel elements of substantially equal pixel area, each color pixel element including a photoreceptor having a device geometry, responsive to receiving light,

to generate an output signal indicative of an amount of light photons received." Further, "a first one of the color pixel elements" is "configured and arranged to receive a first color of light, the photoreceptor of the first one of the color pixel elements having a first geometry and a responsivity to light that is a function of the first geometry of the photoreceptor," "a second one of the color pixel elements" is "configured and arranged to receive a second color of light different than the first color of light, the photoreceptor of the second one of the color pixel elements having a second geometry and a responsivity to light that is a function of the second geometry," and "a third one of the color pixel elements" is "configured and arranged to receive a third color of light different than the first color of light and the second color of light, the photoreceptor of the third one of the color pixel elements having a third geometry and a responsivity to light that is a function of the third geometry of the photoreceptor."

As noted above, Fossum et al. '100 teaches that when increasing the pixel area the photodiode size should not change, i.e., "increase the photosensitive area of the pixel *without* corresponding increase in the size of the doped photodiode region." Fossum et al. '100 does not teach or suggest an assembly with a plurality of macro pixels in which each of three different color pixel elements of "substantially equal pixel area" has a "photoreceptor having a device geometry" and each color pixel element is "configured and arranged to receive a [respective] color of light" and "a responsivity to light that is a function of the [respective] geometry of the photoreceptor."

Claim 13 is patentable over Fossum et al. '100. Claims 14 and 15 depend from Claim 13 and are patentable over Fossum et al. '100 for at least the same reasons.

Claims 2-3 and 16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Fossum et al. '100 in view of U.S. Pat. No. 6,040,592 to McDaniel et al. Reconsideration of this rejection is respectfully requested.

Claims 2 and 3 depend from claim 1, which is patentable over Fossum et al. '100 as advanced above. McDaniel et al. does not remedy the deficiencies of Fossum et al.

'100. McDaniel et al. has been cited to teach pixel elements of various types (n-wells, n+ diffusion, p-wells, etc.) McDaniel et al. teaches a photodiode with an adjacent FET structure, which constrains adjustment of the optical properties of the photodiode. McDaniel et al. does not combine with Fossum et al. '100 to provide a macro-pixel in which each of at least two different color pixel elements of "substantially equal pixel area" has a "photoreceptor having a device geometry" and each color pixel element "having a [respective] geometry and responsivity to receive [a respective] color of light that is a function of the [respective] geometry" of the photoreceptor.

Moreover, any reference to be combined with Fossum et al. '100 would need to change the size of the photoreceptor in order to provide "at least two different color pixel elements of "substantially equal pixel area" with a "photoreceptor having a device geometry" and each color pixel element "having a [respective] geometry and responsivity to receive [a respective] color of light that is a function of the [respective] geometry" of the photoreceptor. The combination would fail to establish *prima facie* obviousness, however, because the change would be contrary to the fundamental teaching in Fossum et al. '100 "to increase the photosensitive area of the pixel *without* corresponding increase in the size of the doped photodiode region."

Claim 1 is patentable over Fossum et al. '100 in view of McDaniel et al. Claims 2 and 3 depend directly from claim 1 and are patentable over Fossum et al. '100 for at least the same reasons.

Claim 16 depends from claim 13. Claim 13 is patentable over Fossum et al. '100 as advanced above. McDaniel et al. does not remedy the deficiencies of Fossum et al. '100. McDaniel et al. has been cited as teaching a variety of different photoreceptors. McDaniel et al. does not and can not combine with Fossum et al. '100 to provide an assembly with a plurality of macro pixels in which each of three different color pixel elements has "substantially equal pixel area" and a "photoreceptor having a device geometry" in which each color pixel element is "configured and arranged to receive a

[respective] color of light" and "a responsivity to light that is a function of the [respective] geometry of the photoreceptor."

Claim 13 is patentable over Fossum et al. '100 in view of McDaniel et al. Claim 16 depends directly from claim 13 and is patentable over Fossum et al. '100 in view of McDaniel et al. for at least the same reasons.

Claims 8-9 and 17-18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Fossum et al. '100 in view of U.S. Pat. No. 5,949,483 to Fossum et al. Applicant respectfully requests reconsideration of this rejection.

Claims 8-9 depend from claim 1. Claim 1 is patentable over Fossum et al. '100 as advanced above. Fossum et al. '483 does not cure the deficiencies of Fossum et al. '100. Fossum et al. '483 has been cited as providing a microlens coupled to a pixel. Fossum et al. '483 is silent as to photoreceptor geometry. Claim 1 is patentable over Fossum et al. '100 in view of Fossum et al. '483. Claims 8-9 depend directly and indirectly, respectively, from claim 1 and are patentable over Fossum et al. '100 in view of Fossum et al. '483 for at least the same reasons.

Claims 17-18 depend from claim 13. Claim 13 is patentable over Fossum et al. '100. Fossum et al. '483 does not cure the deficiencies of Fossum et al. '100. Fossum et al. '483 has been cited as providing a microlens coupled to a pixel, and is silent as to photoreceptor geometry. Claim 13 is patentable over Fossum et al. '100 in view of Fossum et al. '483. Claims 17-18 depend directly from claim 13 and are patentable over Fossum et al. '100 in view of Fossum et al. '483 for at least the same reasons.

Claims 10-11 and 19-23 stand rejected as being unpatentable over Fossum et al. '100 in view of U.S. Pat. No. 5,119,181 to Perregaux et al. Reconsideration of this rejection is respectfully requested.

Claims 10-11 depend from claim 1. Claim 1 is patentable over Fossum et al. '100 as advanced above. Perregaux et al. does not cure the deficiencies of Fossum et al. '100. Perregaux et al. has been cited as providing a macro pixel in which "at least one of the color pixel elements further comprises at least one switch coupled to the photoreceptor to vary the device geometry." Applicant respectfully disagrees, and notes that Perregaux et al. does not contain any discussion of a macro pixel with a "switch coupled to the photoreceptor to vary device geometry." The Office Action urges that Perregaux et al. teaches a photodiode shape that can be altered to change the spatial sensitivity of individual photodiodes; this teaching is not, however, equivalent to a macro pixel in which "at least one of the color pixel elements further comprises at least one switch coupled to the photoreceptor to vary the device geometry." Moreover, Perregaux et al. does not combine with Fossum et al. '100 to provide an assembly with a plurality of macro pixels in which each of three different color pixel elements has "substantially equal pixel area" and a "photoreceptor having a device geometry" in which each color pixel element is "configured and arranged to receive a [respective] color of light" and "a responsivity to light that is a function of the [respective] geometry of the photoreceptor."

Claim 1 is patentable over Fossum et al. '100 in view of Perregaux et al. Claims 10-11 depend directly and indirectly, respectively, from claim 1 and are patentable over Fossum et al. '100 in view of Perregaux et al. for at least the same reasons.

Claims 19-20 depend from claim 13. Claim 13 is patentable over Fossum et al. '100 as advanced above. Perregaux et al. does not cure the deficiencies of Fossum et al. '100. Perregaux et al. has been cited as providing a macro pixel in which "at least one of the color pixel elements further comprises at least one switch coupled to the photoreceptor to vary the device geometry." Applicant respectfully disagrees: Perregaux et al. does not disclose a "switch coupled to the photoreceptor to vary device geometry," and the Office Action admits that this is missing from Fossum et al. '100. The Office Action states that Perregaux et al. teaches altering a photodiode shape to change spatial sensitivity. This teaching is not, however, equivalent to a macro pixel in which "at least one of the color

pixel elements further comprises at least one switch coupled to the photoreceptor to vary the device geometry." Moreover, Perregaux et al. does not combine with Fossum et al. '100 to provide at least two different color pixel elements of "substantially equal pixel area" that have a "photoreceptor having a device geometry" and each color pixel element "having a [respective] geometry and responsivity to receive [a respective] color of light that is a function of the [respective] geometry" of the photoreceptor.

Claim 13 is patentable over Fossum et al. '100 in view of Perregaux et al. Claims 19 and 20 depend directly and indirectly, respectively, from claim 13 and are patentable over et al. '100 in view of Perregaux et al. for at least the same reasons.

Claim 21 recites a color pixel assembly including at least one macro pixel. The macro pixel includes "at least three color pixel elements having equal pixel areas, each color pixel element including a photoreceptor having a device geometry and at least one switch configured and arranged to selectively change the device geometry, responsive to receiving light, to generate an output signal indicative of an amount of light photons received." A "first of the color pixel elements" is "configured and arranged to receive a first color of light, the photoreceptor of the first of the color pixel elements having a first geometry and a responsivity to light that is a function of the first geometry of the photoreceptor, the responsivity of the output signal of the photoreceptor to the first color being controllable by changing the first geometry." A "a second of the color pixel elements" is "configured and arranged to receive a second color of light different than the first color of light, the photoreceptor of the second of the color pixel elements having a second geometry and a responsivity to light that is a function of the second geometry, the responsivity of the output signal of the photoreceptor to the second color being controllable by changing the second geometry." A "third one of the color pixel elements" is "configured and arranged to receive a third color of light different than the first color of light and the second color of light, the photoreceptor of the third one of the color pixel elements having a third geometry and a responsivity to light that is a function of the third geometry of the

photoreceptor, the responsivity of the output signal of the photoreceptor to the third color ~~is~~ being controllable by changing the third geometry."

Fossum et al. '100, as noted above, teaches that when increasing the *pixel* area the *photodiode* size should not change. Fossum et al. '100 does not teach or suggest, but rather teaches away from, a "color pixel element including a photoreceptor having a device geometry and at least one switch configured and arranged to selectively change the device geometry, responsive to receiving light, to generate an output signal indicative of an amount of light photons received."

Perregaux et al. does not remedy the deficiencies of Fossum et al. '100. Perregaux et al. is silent as to a "switch configured and arranged to selectively change the device geometry." Perregaux et al. does not combine with Fossum et al. '100 to provide, for example, a "color pixel element including a photoreceptor having a device geometry and at least one switch configured and arranged to selectively change the device geometry, responsive to receiving light, to generate an output signal indicative of an amount of light photons received."

Claim 21 is patentable over Fossum et al. '100 in view of Perregaux et al. Claims 22 and 23 depend directly and indirectly, respectively, from claim 21 and are patentable over Fossum et al. '100 in view of Perregaux et al. for at least the same reasons.

Claim 24 stands rejected as being unpatentable over Fossum et al. '100 in view of Perregaux et al., further in view of McDaniel et al. Applicant respectfully requests reconsideration of this rejection.

Claim 24 depends from claim 21. Claim 21 is patentable over Fossum et al. '100 in view of Perregaux et al. as advanced above. McDaniel et al. does not remedy the deficiencies of Fossum et al. '100 in view of Perregaux et al. McDaniel et al. has been cited as providing a particular photodiode structure. McDaniel et al. teaches a photodiode structure that is constrained in adjustment of optical properties, and in any event does not

teach or suggest a switch so as to combine with Fossum et al. '100 in view of Perregaux et al. to establish *prima facie* obviousness of claim 21. Claim 21 is patentable over Fossum et al. '100 in view of Perregaux et al., further in view of McDaniel et al. Claim 24 depends directly from claim 21 and is patentable over Fossum et al. '100 in view of Perregaux et al., further in view of McDaniel et al. for at least the same reasons.

In view of the above amendment and remarks, applicant believes the pending application is in condition for allowance.

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Respectfully submitted,

By_____

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